

MONTHLY WEATHER REVIEW,

JULY, 1879.

(General Weather Service of the United States.)

WAR DEPARTMENT,

Office of the Chief Signal Officer,

DIVISION OF

TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

INTRODUCTION.

In preparing this REVIEW the following data, received up to August 13th, have been used, viz: the regular tri-daily weather charts, containing the data of simultaneous observations taken at 124 Signal Service stations and 12 Canadian stations, as telegraphed to this office; monthly journals and means 137 and 140 respectively, from the former; reports from 37 Sunset stations; 223 monthly registers from Voluntary Observers; 43 monthly registers from United States Army Post Surgeons; Marine Records; International Simultaneous Observations; monthly reports from Voluntary Observers in, and the local Weather Services of, the States of Iowa and Missouri; reliable newspaper extracts; special reports.

BAROMETRIC PRESSURE.

Upon chart No. II is shown by the isobaric lines the general distribution of atmospheric pressure, as reduced to sea-level, for the month.

The Local Barometric Ranges have varied as follows: Pacific Coast 0.50 at Roseburg to 0.22 at San Diego; Western Plateau, 0.41 at Virginia City to 0.24 at Boise City; Rocky Mountains, 0.33 at Denver to 0.26 at Santa Fe: summit of Pike's Peak, 0.30; Gulf States, 0.41 at Montgomery to 0.22 at Punta Rassa and Key West; Atlantic States, 0.78 at New York city to 0.43 at Jacksonville; summit of Mt. Washington, 0.63; Ohio valley and Tennessee, 0.62 at Pittsburgh to 0.38 at Cairo; Lake region, 0.79 at Rochester to 0.60 at Chicago; Northwest and Eastern Slope, 0.69 at Pembina to 0.40 at Deadwood and Leavenworth.

Areas of High Barometer.—Of these, three have been sufficiently marked to merit a description.

No. I.—This area, central in New York on the morning of the 1st, moved almost due south, and passed off the North Carolina coast the evening of the 2nd. Maximum abnormal barometric pressures of +0.31 at Albany morning of the 1st, and of +0.32 at Cape Henry the morning of the 2nd, were reported. Generally clear weather, with no precipitation, prevailed during its passage in the New England and Middle Atlantic States. This area caused the minima temperatures for the Southern Atlantic and a portion of the Middle Atlantic States. A minimum temperature of 38° was reported from Rockliffe the morning of the 1st, and light frost at Hector, Starkey and Niles, N. Y., and Springfield, Mass. Brisk northerly winds prevailing on the North Carolina coast the morning of the 1st, Cautionary Signals were displayed. They were lowered that afternoon, having been justified with a maximum velocity of 28 miles NE. at Cape Lookout. Maximum velocities of 25 miles on the 1st and 26 miles on the 2nd were reported from Cape May.

No. II.—From its influence on the Northwestern barometers on the 3rd, it is evident that this area was then central in Saskatchewan, and by the morning of the 4th had reached Manitoba; Bismarck barometer 0.14 abnormally high. Moving nearly due east, accompanied by light to fresh northerly winds and generally clear weather, it reached Ontario the morning of the 5th; Rockliffe barometer 30.34. At that time clear weather, with fresh NE. winds, generally prevailed on the Lower Lakes and New England; cloudy weather, with brisk north to high north winds, in Middle Atlantic, and brisk westerly winds on North Carolina coast. Maximum velocity had been reported of 25 miles W. at Hatteras, N. 26 at Barnegat, and 40 NE. at Sandy Hook. At noon Cautionary Signals were hoisted from Cape Lookout along the coast north to include Wood's Holl. Moving SE., by afternoon of the 5th the centre had passed off the New England coast,

at which time brisk to high N.E. winds prevailed on the New Jersey and North Carolina coasts, with rain in connection with a small area of depression existing in the South Atlantic States. The Signals from Wood's Holl south to include Norfolk were lowered the afternoon of the 5th, and from Cape Henry south to include all displayed on the afternoon of the 6th. The pressure remained nearly stationary S. of the New England and E. of the Middle Atlantic States, with no change until the morning of the 7th. They were all justified, maximum velocities of 32 SW. at Wood's Holl and 32 NE. at Cape Henry and Cape Lookout being reported. The passage of this area was marked by the minimum temperatures generally for New England and the Middle Atlantic States and a considerable portion of the Lake region. A minimum temperature of 33° was reported from Sydney, C. B., the morning of the 6th, during the night of which date a sharp frost was reported from the Magdalen Island and a light frost 5th and 6th at Hector, N. Y.

No. III.—This area was central in northeastern Minnesota the morning of the 18th; Duluth barometer 0.25 above the normal. Moving thence nearly east, it skirted the northern edge of Lake Huron, and by the morning of the 19th had reached eastern Quebec, and that afternoon in lower St. Lawrence valley; Quebec barometer 0.31 abnormally high. Its direction then changed to nearly due south, and on the morning of the 20th it was central in Massachusetts; Albany barometer 0.30 and Boston 0.28 above the normal. It passed south that afternoon, and remained central over the Atlantic Ocean off the Middle Atlantic coast, with almost stationary pressure until the afternoon of the 21st. Its passage was marked by cool northerly winds and generally clear weather over the Lake region, New England and Middle Atlantic States. No signals were displayed. Several instances of brisk to high winds, ranging from SW. 27 at Eastport to NE 32 at Cape Lookout, were reported from the 18th to the 21st and an easterly gale in the Bay of St. Lawrence.

No. IV.—This area traversed the British possessions north of the Lake region during the 23rd and 24th, causing fresh to brisk north to east winds—maximum, Sandusky 30 miles E., reported at midnight of the 24th—with generally clear weather south of the centre. On the morning of the 25th the pressure was central in lower St. Lawrence valley; Quebec barometer 0.23 above the normal—with clear weather and gentle N. to E. winds in New England, fresh to brisk easterly winds in the Middle Atlantic States. Signals were then ordered for the Jersey coast, and at noon, increasing winds with 27 miles S. at Kittyhawk being reported, signals were displayed on the Carolina coast, and in connection with advancing low area No. VII, remained displayed until the morning of the 27th. The signals were fully verified by south and southwest winds on the Carolina coast, ranging from S. 29 miles at Cape Henry to S. 35 at Macon, and on the Jersey coast from S. 28 at Atlantic City to SW. 37 at Sandy Hook. The high pressure moved rapidly from Quebec southeast, and on the afternoon of the 25th passed off the New England coast.

Areas of Low Barometer.—Upon chart No. I are shown the tracks of nine areas which have been sufficiently marked and extensive to enable their course to be accurately charted. A continuation of area No. IX described in the *June Review* is not charted, as central the morning of the 1st in Manitoba—Pembina barometer 0.32 below the normal—it had passed by afternoon beyond our stations. Its passage was marked the afternoon of the 30th of June, by a violent local storm at Bismarck, unroofing houses and wrecking a large steamboat, and from Fort Garry was reported a high northwest wind the morning of the 1st of July, and 1.45 inches rain-fall in eight hours.

No. I.—This area appears to have developed in California during the 1st, from the depression remaining from area No. IX described in the *June Review*. Moving east it was central in Colorado the morning of the 2nd, whence its course was northeastward during the day and central the morning of the 3rd in eastern Dakota, the depression increasing from maximum 0.18 below barometric normal at North Platte the morning of the 2nd to 0.36 below at St. Paul the morning of the 3rd. The passage of the area on the 2nd was marked by local storms of the most violent character. At Elkhorn, Dakota, a tornado, at 5:30 p. m., traveling in circular course from SW. to SE., totally destroyed three buildings, and injured one person. In Plymouth Co., at La Mars, Iowa, about 7 p. m. 2nd, violent storm, shaped like an hour-glass, destroying a number of buildings and killing two persons. In Goodhue Co., Minn., at Belle Creek, buildings demolished; whence traveling northeast through Vasa it demolished a church and orphanage, killing nine persons and injuring thirty others. At Lake Emily, five persons killed and many buildings destroyed. At Red Wing, very violent, damaging many buildings, and crossed the Mississippi river into Pierce Co., Wis., where many buildings were destroyed at Maiden Rock and Trenton. At Warren, flood followed by which four persons perished. St. Paul, Minn., on morning of 3rd reported 3.70 inches rain in preceding 8½ hours and 4.93 inches in preceding 15 hours. In Steele Co., Minn., a succession of violent thunderstorms occurred. At Yankton, Dakota, the barometer in seventeen hours fell abnormally 0.37 and at St. Paul 0.39. On the morning of 3rd the area moving rapidly eastward signals were displayed on Lake Michigan. Reports missing from the Northwest, cloudy weather, with brisk southerly winds, prevailing on Lakes Michigan and Huron. By afternoon the centre was over Lake Superior; Marquette barometer 0.33 below normal. Signals were then lowered, having been justified by velocities from NW. 27 miles at Escanaba to NE. 38 at Milwaukee, except at Alpena, where velocity of 24 miles was reported. At Sandusky W. 28 miles on the 2d, and at Marquette NW. 28 miles on the 3rd, were reported. The centre moved eastward through Ontario and on the morning of the 4th, was central in lower St. Lawrence valley; Quebec barometer 0.44 below the normal. At that time, brisk northerly winds, with cloudy weather, on the Lower Lakes, and gentle to brisk SW. winds, with partly cloudy weather in New England and the Middle Atlantic States, were reported. Signals were then displayed for Lake Ontario, the Carolina coast, at Newport and Wood's Holl. At the afternoon

report the storm had passed into the Gulf of St. Lawrence and the signals were lowered. The signals on Lake Ontario were not justified. The Carolina signals were all justified; maximum velocity at Cape Hatteras SW. 28. At Newport and Wood's Holl the signals were justified by SW. 25 and SW. 32, but were somewhat late at Wood's Holl, where SW. and W. winds from 26 to 28 miles had prevailed from the 2nd to morning of the 4th. By the afternoon of the 4th the storm-centre had passed into the Gulf of St. Lawrence; Sydney barometer 0.52 below the normal, followed by cloudy weather and rain in New England, with brisk westerly winds, a maximum velocity of W. 27 miles being reported during the afternoon from Boston.

No. II.—This area first appeared in the Valley of the Sacramento July 2nd, where its course during the 3rd, 4th and 5th was a little north of east through Idaho and Montana, and was in Dakota the morning of the 6th; Bismarck barometer 0.28 below the normal. At that report high easterly winds, with cloudy weather, prevailed in the Northwest, with heavy rain-falls, 1.33 inches in less than eight hours at Pembina. The course of the centre was thence northeast, and in the afternoon it was in eastern Manitoba—all reports from the Northwest missing. The abnormal barometric isobar of -0.20 included Dakota, Minnesota and parts of Iowa and Wisconsin. A terrific hail-storm that morning prevailed in Meeker and Kandiyohi counties, Minn., and during the afternoon violent thunder-storm at Madison, Wis., with hail large enough to kill yearlings, and 1.83 inches in seven hours. At La Crosse, Wis., severe thunder-storm, with 1.30 inches rain-fall in one and a half hours. Although the centre had passed into Manitoba, the trough in the Upper Mississippi valley changed but little from the afternoon of the 6th to the morning of the 7th, at which time the rain-fall at Madison was reported as 3.70 inches in twenty-four hours, and at La Crosse 4.70 inches for the same period. On the afternoon of the 6th fresh to brisk southerly winds, with cloudy weather and rain, prevailed on the Upper Lakes, with a maximum velocity of 41 miles, SW. reported from Milwaukee. At midnight a maximum velocity of 44 miles SW. was reported from Marquette. On the morning of the 7th reports from the Upper Mississippi valley and the Northwest were missing, and brisk southerly winds, with cloudy weather and light rains, were reported from the Lower Lakes, when signals for Lake Erie were ordered, which were lowered at midnight of the 7th, being justified, except at Port Huron and Buffalo, by winds ranging from SW. 28 at Sandusky and Toledo to S. 33 at Cleveland. At midnight of the 7th signals were displayed from Cape May northward along the Atlantic coast to include Eastport. By the morning of the 8th the area was probably central in northwestern Quebec. At that time Parry Sound barometer was 0.38 below the normal, and brisk S. and SW. winds were reported, with cloudy weather and rain, from New England and South Atlantic States to the Lake region. Velocities from 28 S. at Cape May to 33 SE. at Sandy Hook prevailed, while the brisk winds on the North Carolina coast, (maximum velocity S. 25 miles at Cape Henry,) were followed by signals from Cape Henry south to Macon. The area moving northeast all signals were lowered on the Atlantic coast the afternoon of the 8th, having been justified, except at Cape Henry and Eastport, by velocities ranging from SW. 25 at Macon to S. 38 miles at Wood's Holl. The storm central in northeastern Quebec at midnight of the 8th changed its course from northeast to south-east, and on the morning of the 9th was central in lower St. Lawrence valley; Father Point barometer 0.38 below the normal. At that time fresh to brisk north winds, with clear weather, were reported from New England, and cloudy weather, with heavy rain and fresh winds, from the Canadian Maratime stations, except a velocity of S. 30 miles from Father Point. Central the afternoon of the 9th in New Brunswick and at midnight in Nova Scotia the area passed southeastward over the Atlantic Ocean. No high winds were reported on the morning of the 10th.

No. III.—This area appeared first in the Middle Plateau district on the 7th, and moving nearly east passed through Idaho and Wyoming on the 8th and 9th, and was central in Western Dakota the morning of the 10th; Yankton barometer 0.29 below the normal. At that time heavy rains were reported from Minnesota and Wisconsin, with cloudy weather and variable winds over the whole Lake region. Moving nearly east, the centre was in Minnesota at midnight of the 10th and over Lake Michigan the morning of the 11th, Milwaukee barometer 0.43 below the normal when brisk N. to W. winds prevailed over Lakes Superior and Michigan, and southerly winds with cloudy weather and no precipitation on the Lower Lakes, except a heavy rain fall of 2.06 inches reported for previous eight hours from Sandusky. Cautionary Signals were then ordered for Lakes Michigan, Huron and Erie. By the afternoon of the 11th it was central over Lake Ontario, which was covered by an average barometric pressure of 0.43 below the normal, while the abnormal isobar of -0.30 covered New England, Middle Atlantic States and the Lower Lakes. The Lake signals were then lowered, having been justified for Lake Erie, maxima velocities of N. 45 miles at Cleveland and N. 67 at Sandusky being reported. The signals for Lakes Michigan and Huron were not justified by reports yet received. Severe and destructive local storms occurred during the day in Canada, Ohio, Michigan, Pennsylvania and Maryland, which are mentioned under Local Storms. At this time cloudy weather and brisk southerly winds were reported from New England and the Middle Atlantic States, with a maximum velocity of 30 miles SW. wind at Cape Lookout. Cautionary Signals were then displayed for the New Jersey coast from Lewes to Sandy Hook. At midnight of the 11th the area was central in Connecticut; New York barometer 0.48 abnormally low. At this time the Signals from Lewes to Sandy Hook were lowered, having been fully justified by winds ranging in maximum velocity from SE. 26 miles at Barnegat to 30 S. at Cape May. Brisk to high SW. winds were, however, reported from the North Carolina coast, and a velocity of NW. 46 miles at Cape Henry. On the morning of the 12th the area was central off the New Jersey coast—Atlantic City barometer 0.47 below the normal—and brisk winds were reported, NE. in

New England, NW. on the Jersey coast and SW. on the North Carolina coast, with rainfall in past eight hours from New England to Ohio valley. The centre thence moved west of south, and in the afternoon of the 12th was in North Carolina; Wilmington barometer 0.36 below the normal. At noon, however, high northerly winds, of maximum velocities ranging from N. 30 at Cape May to N. 35 at Barnegat, had been reported and Cautionary Signals displayed from Cape Henry south to include Macon. These Signals were lowered that afternoon, having been fully justified by maxima velocities ranging from NE. 26 miles at Cape Henry to N. 35 at Macon. These signals were lowered somewhat soon, as the centre, moving southwestward, was central at midnight of the 12th on the South Carolina coast, and NE. winds, with maximum velocities from 26 to 32 miles, were reported from the North Carolina coast. The area moved slowly off the South Carolina coast during the 13th. This area produced the maximum temperatures of the month for the Upper Mississippi, Tennessee and Ohio valleys and the South Atlantic States, in the last of which sections the highest temperatures ever known were experienced, reaching 104° at Charleston and Augusta and 105° at Savannah on the 12th and 104° at Jacksonville on the 11th.

No. IV.—During the 10th the pressure fell from the Pacific coast to Utah and Western Montana, with cloudy and threatening weather and light rains on the coasts of Oregon and Washington Territory. 11th, pressure fell rapidly over Oregon, Washington Territory, Idaho and western Montana, reaching the minimum (29.53 and 29.51 or 0.50 and 0.48 below the normals respectively,) at Portland and Olympia at 4:35 p. m., and (29.50 or 0.30 below) at Virginia City at 11 p. m.; the observer at New Westminster, B. C., reported "at 6 p. m., barometer 29.43, wind WSW., heavy blue black clouds from W. moving rapidly—midnight, wind backed to S. and then SE. and blew a heavy gale in fierce gusts with very heavy rain until 9 a. m. 12th—nothing like this known here before in July;" about the same hour (6 p. m.) a "violent wind and rain-storm" occurred at Umatilla, Or.; and a "severe local storm also passed over Dayton, Columbia Co., Washington, Ty., which struck Pomeroy, 10 miles from Dayton ten minutes later." 12th, passed rapidly eastward over or to the north of Montana; light rains fell at the Rocky Mountain stations and in the Lower Missouri valley, and at 11 p. m. threatening weather was reported in the Red River of the North valley. It was followed on the Pacific coast by cold weather, the minimum temperature of the month (40°) being reported at Roseburg, while the maximum temperatures of the month were reported at several stations over the Eastern Slope of the Rocky Mountains: Cheyenne, 95°; Deadwood, 92°; Bismarck, 95°; Pembina, 90°; Pilot Point and Coleman, Tex., 107°. 13th, was probably central north of Lake Superior; a severe thunderstorm with heavy rain occurred at Duluth during the early morning, (5 to 10 a. m.) followed at noon by a brisk southwest wind, 28 miles at Duluth and SE. 31 at Milwaukee, for which signals were not ordered. High temperatures continued over the eastern section of the country and the following maxima of the month were recorded: Denver, 98°; North Platte, 99°; Henrietta, Tex., 105°; Graham, 109°; Concho, 108°. Its course from the 13th to the afternoon of the 14th was too far north of our stations to be accurately traced; but at the latter report it was central in Vermont, marked by little energy; Burlington barometer 0.13 below normal. Thence moving NE. at midnight it was central in Maine, and the morning of the 15th in New Brunswick, its progress marked by no high winds and light precipitation. No signals were ordered and no dangerous winds reported.

No. V was north of the Lake region, in Ontario, the morning of the 15th; Parry Sound barometer 0.11 below the normal. Moving nearly east, it was central in eastern Ontario during the afternoon and midnight. At the latter report clear weather and fresh westerly winds prevailed on the Lower Lakes and fresh southerly winds with partly cloudy weather and rain areas in New England. Severe local storms, with hail and heavy winds, prevailed in various parts of Ontario during the day. On the 16th, in the morning, it was in the Upper St. Lawrence valley; Quebec barometer 0.25 below the normal, with falling barometer and fresh S. to W. winds, and clear weather with very high temperature reported from New England. During the day it moved southeast, and in the afternoon was central in Maine; Burlington barometer 0.33 and Eastport barometer 0.30 below the normal. At this time fresh to brisk easterly winds with cloudy weather prevailed in the Lower St. Lawrence valley and variable winds, with violent thunderstorms in New England, with maxima velocities of 38 miles NW. at Boston and 40 NW. at Wood's Holl, and SW. winds from 26 to 28 miles from the North Carolina coast, with cloudy weather and rain. During the day the maximum temperatures for the month occurred at most stations from Virginia to Massachusetts, which were followed over New York and New England by a series of violent thunderstorms and cooler weather. The numerous cases of sunstroke will be found noted under Temperature, and the violent storms, by which many lives were lost and great damage done to property, under Local Storms. By midnight of the 16th the centre had reached eastern Maine; Eastport barometer 0.38 below the normal, with fresh S. to W. winds, cloudy weather and heavy rainfall in New England. Maximum velocities, from several stations, ranging from 25 to 32 miles, were reported from the New Jersey and North Carolina coasts. On the 17th the area, in Nova Scotia in the morning and near Cape Breton at the afternoon report, passed northeastward over the Atlantic Ocean, attended by gales and terrific squalls, the depression having increased to 0.50 below the barometric normal at Halifax in the morning and at Sydney in the afternoon.

No. VI.—This area, appearing in western Nebraska the afternoon of the 21st and moving nearly east, passed through Nebraska and Iowa with little energy, reaching Wisconsin the afternoon of the 22nd; Milwaukee barometer 0.17 below the normal; by midnight it had reached Lake Huron, with cloudy weather and heavy rains on the Lower Lakes, fresh SW. to SE. winds, but one station, Sandusky, reporting a maximum velocity of SW. 25 miles on the Lakes, and Cape May S. 30 on the Atlantic coast. On the 23d it was central at the

morning report in Ontario; Kingston barometer 0.32 below the normal; brisk SW. winds and cloudy weather in the Middle Atlantic States and New England, accompanied in the latter by heavy rains. In the afternoon central in Maine, brisk SW. winds were reported from Carolina to Massachusetts, with a maximum velocity of 28 SW. at Cape Lookout. The course of the area was northeast, and by midnight it had passed into the Gulf of St. Lawrence. No signals were displayed during the passage of this area.

No. VII.—This area, whose presence was first shown by the barometers in the Northwest on the 24th was central on the morning of the 25th in eastern Manitoba; Pembina barometer 0.33 below the normal generally cloudy weather, with southerly to westerly winds and light local rains, being reported from the Upper Lakes and Northwest; moving southeasterly, with increased pressure, it was central over Lake Superior, midnight of that date. During the day southerly to westerly winds and cloudy weather had prevailed, with moderate rain-fall over the Lake region and Northwest. On the 26th, in the morning, the depression was central over Lake Michigan; Escanaba, barometer 0.26 below the normal; in the afternoon in eastern Michigan. At midnight it reached southern Ontario. During the day, rainy weather, with brisk to high southerly winds, on the New Jersey and North Carolina coasts, and rainy weather, with fresh easterly winds, in New England, were reported, while clear weather and fresh southerly winds prevailed over the Lake region. Signals displayed in connection with high area No. IV on the 25th from Macon north to Sandy Hook inclusive were continued up, and during the afternoon of the 26th signals were displayed at New York. On the morning of the 27th, the pressure passed off the New England coast; Portland barometer 0.28 below the normal. At this time fresh to high northerly winds, 30 miles NE. at Eastport Me., with cloudy weather and heavy rain-falls, were reported from New England, and fresh to brisk west to southwest winds from the New Jersey and North Carolina Coasts. All the Signals on the Atlantic coast were then lowered, having been fully justified, as shown in connection with high area No. IV.

No. VIII.—This area appears to have sprung up from the remains of area No. VII, and at midnight of the 27th was central north of Lake Superior, at which time fresh westerly winds, with heavy rain-falls, were reported from that Lake. On the morning of the 28th the central pressure had reached the eastern part of Lake Superior; Marquette barometer 0.22 below the normal. Moving eastward through Ontario at midnight it was central at Quebec, and on the morning of the 29th passed into the Gulf of St. Lawrence. The passage of the area was marked by little energy, and no dangerous winds in connection therewith were reported.

No. IX.—This area was central in western Manitoba on the afternoon of the 30th, and by midnight had reached central Dakota; Bismarck and Pembina barometers, respectively, 0.29 and 0.31 below the normal. Its course during the 31st was a little east of south while its movement was sluggish, and its pressure increasing being 0.18 below the normal at Yaukton on midnight of the 31st. No dangerous winds were reported in connection with this area.

INTERNATIONAL METEOROLOGY.

WORLD WEATHER CHARTS—Meteorological Charts of the Northern Hemisphere.—It has been the plan of these charts that they should be based upon observations taken simultaneously by day and at night on land and at sea. The observations to be those of the barometer, thermometer, weather, etc., had everywhere on the globe at the same fixed instant of physical time—That is for example observations so arranged that those at Washington, St. Petersburg, Constantinople, etc., are taken not at the same hours of local or clock time at those cities—for they would not then be taken at the same moment, but so arranged that the readers or observers are actually at the instruments at once, all reading and recording at one and at the same moment the readings and records are being made at every other station, and so for all places. The atmosphere over any extent of the earth can thus be viewed as a whole, and at once before any movements in it are possible. The resulting charts give a true synopsis—in effect a photograph of the atmosphere and its conditions at the instant. Such observations are known as SIMULTANEOUS OBSERVATIONS. They are characteristic of the work of this office. They were for the first time practically employed by it for purposes of prediction in 1870. Simultaneous observations as thus described are, upon the invitation of the United States, widely taken throughout the world. They are collated at this office, printed and issued daily, forming "The International Bulletin of Meteorological Observations taken simultaneously." The International co-operation, embraces observations taken by almost every civilized power north of the equator, and observations taken at sea.

Four charts, based upon International Meteorological Observations, taken simultaneously, are issued with this *Review*. These charts have been specially prepared. The subject of the preparation of such World Charts is referred to in the annual report of the Chief Signal Officer for the year 1878 and in preceding reports. They embrace within their limits the Northern Hemisphere.

Chart No. IV is based on the *Bulletin of International Meteorological Observations*, taken at 7:35 a. m., Washington mean time, under date of December 26, 1878, and exhibits in graphic form the barometric pressure and temperatures over the Northern Hemisphere so had for that date and hour. Lines of equal barometric pressure and equal temperature are charted and their values are expressed in French and English measures. Extended areas of high pressures and marked barometric depressions are respectively indicated as High, Higher, Highest and Low, Lower, Lowest. This map presents the data of the bulletin for the day charted for study. It is a map of the Northern Hemisphere and is charted daily.